

Landsat Advisory Group Update

July 22, 2014

LAG Co-Chairs

Kass Green and Roger Mitchell

Outline

1. Review LAG charter and membership
2. Summarize LAG 2013 White Papers
3. Request for input from LST members.

1. LAG Charter & Membership

- The LAG is a subcommittee of the Department of Interior's National Geospatial Advisory Committee (NGAC) which is a Federal Advisory Committee or "FACA".
- "The NGAC Landsat Advisory Group (LAG) will provide advice to the Federal Government, through the NGAC, on the requirements, objectives and actions of the Landsat Program as they apply to ongoing delivery of societal benefits for the Nation and the global Earth observation community."

LAG Membership 2014

Name	Organization
Kass Green (LAG Co-Chair)	Kass Green & Associates
Roger Mitchell (LAG Co-Chair, NGAC Member)	MDA Information Systems LLC
Peter Becker	ESRI
John Copple	Sanborn Map Co.
Joanne Gabrynowicz (NGAC Member)	University of Mississippi
Jack Hild (NGAC Member)	DigitalGlobe, Inc
Rebecca Moore	Google, Inc.
Michele Motsko (NGAC Member)	NGA
Tony Spicci (NGAC Member)	State of Missouri
Cory Springer	Ball Aerospace & Technologies Corp.
Julie Sweetkind-Singer	Stanford University
Tony Willardson	Western States Water Council
Darrel Williams	Global Science & Technology, Inc.

2013 LAG Members

Name	Organization
Kass Green (LAG Co-Chair)	Kass Green & Associates
Roger Mitchell (LAG Co-Chair, NGAC Member)	MDA Information Systems, Inc.
Peter Becker	ESRI
John Copple	Sanborn Map Co.
Dave Cowen	University of South Carolina
Joanne Gabrynowicz (NGAC Member)	University of Mississippi
Rebecca Moore	Google, Inc.
Tony Spicci (NGAC Member)	State of Missouri
Cory Springer	Ball Aerospace & Technologies Corp.
Tony Willardson	Western States Water Council
Darrel Williams	Global Science & Technology, Inc.

2013 LAG Guidance

The LAG is requested to provide advice and recommendations on Landsat-related issues for consideration by the NGAC, including the following:

- Through collaboration with the Landsat Science Team, potential new applications of Landsat imagery and data to benefit land and water managers, governmental planners and land use officials, and any others.
- Current and future Landsat data and information product characteristics, including potential means of modifying the current products to make them more useful to commercial value-added information providers.
- Potential new approaches to data management and distribution (e.g., possible means to “bring algorithms to the data”, rather than to “bring the data to algorithms”; and use of “the cloud” and other new technology developments).
- A dialogue with industry on future development of new terrestrial Climate Data Records (CDRs)
- Review and comment on the National Research Council report on implementing a sustained Land Imaging Program.
- Recommendations on partnership opportunities with existing foreign or commercial missions to maintain and augment DOI/USGS land imaging capability.*

2. Summary of 2013 Papers

- **Comments on NRC Report: *Landsat and Beyond: Sustaining and Enhancing the Nation's Land Imaging Program***
- **CLOUD COMPUTING: Potential New Approaches to Data Management and Distribution**
- **PRODUCT IMPROVEMENT: Advise USGS on potential means of modifying the current products to make them more useful to commercial information providers and value-added analysts**

NRC Report Review

- Author: Dr. David Cowen
- www.fgdc.gov/ngac/meetings/december-2013/ncac-comments-on-NRC-landsat-report-FINAL.pdf
- Findings: “The LAG concurs with the report's findings and recommendations and finds the report to be well reasoned and thorough in scope.”

Cloud Computing Paper

- Authors: Lead – Darrel Williams, Global Science and Technology, Inc. Members – Rebecca Moore, Google; Peter Becker, esri; Tony Willardson, Western States Water Council
- www.fgdc.gov/ngac/meetings/december-2013/ngac-landsat-cloud-computing-paper-FINAL.pdf

Categorization of Models

1. **Data Download:** example - Current Landsat download from USGS EROS
2. **Interactive Online Visualization:** example - Google Maps, Bing Maps and ArcGIS online
3. **Interactive Online Analysis:** on-demand interactive analysis for simple requests
4. **Batch-processing Analysis:** longer-running analyses for complex requests, *a.k.a.* geoprocessing

Cloud Computing Paper Findings con't.

1. Facilitate Landsat cloud implementations by third-party cloud providers.

The EROS Center should create a policy and framework for supporting third-party cloud providers, most importantly by providing a bulk Landsat data download capability that is timely, comprehensive, reliable, and high-bandwidth. There is precedent for this: EROS today supports bulk download via FTP and HTTP.

2. Facilitate the implementation (by EROS and/or third-parties) of methods that provide fast and simple accessibility to imagery, such as Interactive Online Analysis (Model 3 above).

Multiple services can be defined from the same data source that will return specific products processed directly from the Landsat L1T products, such as different band combinations, imagery in 'radiance' or 'reflectance' values, or a wide range of vegetative indices. Such services will significantly improve access to imagery by enabling users of various levels of sophistication to request and receive specific higher-level data products. This concept leverages the efficiency of the cloud by co-locating data and processing; processing only takes place on demand, when the client applications make the requests to the servers, which then process the data and return only the required information.

Cloud Computing Findings con't.

3. Facilitate the implementation (by EROS and/or third-parties) of methods that provide Batch-processing Analysis (Model 4 above), as there are many scientific tasks that cannot be handled by Interactive Online Analysis alone. Tasks such as the recent global forest cover change analyses are too large in extent to be executed in a short time frame and/or can require access to massive volumes of data. There are many different services that could be envisaged which utilize Landsat data, and most of these services would require access to a large number of scene equivalents. Currently, users wanting to perform such analyses need to first download all the required data. An optimal model would be one in which users can define the required processing to be performed on the imagery and then transmit the model to the cloud where processing can be spread across multiple CPUs. Given the need to periodically recalibrate large groups of scenes, such a cloud-based batch-processing service would support efficient, timely reprocessing.

Cloud Computing Paper Findings con't.

4. **The EROS Center should investigate modification of their existing Data Download (Model 1) to enable subsets of L1T products to be downloaded.** Certain types of analyses need only operate over a time-series stack covering a small geographic area of pixels. Note that there is good synergy here with implementation of **Interactive Online Analysis** (Recommendation 2), as one way to facilitate access to such image subsets.
5. **Special attention should be given to the use of open software standards when designing any future system(s) to avoid tying any of these services to proprietary software.**
6. **Although security is an important consideration, security solutions need to be streamlined so as not to slow things down appreciably and/or make things more complicated to implement.** Given that Landsat is a public dataset of broad relevance to society, it would be unfortunate if potential innovations and beneficial applications were thwarted by excessive focus on security.

Product Paper

- Authors: Lead – Peter Becker, esri. Members – Rebecca Moore, Google; Roger Mitchell MDA Information Systems; Tony Spicci, State of Missouri
- www.fgdc.gov/ngac/meetings/december-2013/ngac-landsat-product-improvement-paper-FINAL.pdf

Products Paper Findings

- USGS should
 - Refine Landsat geometric accuracy to enable better change detection and refinement of the radiometric measurements so that they can be better associated with known quantities.
 - Continue to improve the existing L1G product by refining both the geometric and radiometric accuracy through the use of additional control and terrain models used to geometrically correct the imagery as well as through continual calibration of the instruments against ground truth. USGS should seek to improve the co-registration of L1T products. While the current process is very good, it can be improved. USGS should consider additional computational techniques and source data such as a better DEM to improve the co-registration.
 - Strike a balance between the products created by the USGS and those created by commercial organizations. The USGS should clearly define the level of products it will produce and avoid competition with commercial organizations.

Product Paper Findings con't.

- USGS should
 - Define a standard surface reflectance product by documenting and publishing a standardized method for the creation of Surface Reflectance products from Landsat and collecting and distributing the parameters (such as elevation, weather, temperature & humidity) required to compute these from the L1T.
 - Provide the facilities to certify or validate derived products generated by other organizations. This can be achieved in a similar manner that standards organizations check for compliance.

Product Paper Findings con't.

USGS should

- Help consolidate scientific research and publish best practices on how to create a range of products including different indices of vegetation and soil types and Climate Variables. USGS should clearly define these products along with the associated validation criteria for such products, so that multiple commercial and government organizations can create and distribute the products backed by well-defined standards. Where such products are dependent on other sources (such as elevation, or other variables) then these source products should also be made accessible. Such standardization of the product will help establish the more wide spread use of the products.

Product Paper Findings con't.

- USGS should
 - Provide documented samples of the derived products against which organizations can test their product processing. There is little need for USGS to actually create and distribute such products as they can typically be quickly computed from the provided L1T. Multiple organizations could create the products and be able to reference the USGS defined standards or refine them to create higher level products that are still based on these documented standards.

Product Paper Findings con't.

- Make the L1T product simpler to access. The existing products from USGS are currently accessible only via FTP type services that require the complete scene to be downloaded. It is suggested that new APIs (Application Programming Interface) be investigated that enable the subsets of imagery to be downloaded to multiple cloud processing environments which are likely to be used in the near future for the creation and distribution of multiple products created from Landsat imagery. A similar recommendation is provided in the Cloud recommendations (separate LAG document).

2014 NGAC Guidance

Landsat Advisory Group

The LAG is requested to provide advice and recommendations on Landsat-related issues for consideration by the NGAC, including the following:

- Review and update the 2012 LAG paper, “The Value Proposition for Ten Landsat Applications.” The 2012 paper documented an estimated \$178M to \$235M in annual cost savings experienced by federal and state government agencies within ten categories of Landsat data use. Since the 2012 cost savings estimates were compiled by the LAG, the USGS has gathered additional information through a Landsat user survey, a preliminary collection of Landsat-user case studies, and a pilot project on remote sensing user requirements. The USGS will share this information with the LAG to assist in updating the examples used in the 2012 paper, refining the list of user applications within and beyond government agencies, and enhancing the Landsat value summary.

***FGDC Guidance to NGAC, March 2014**

Subtask Assignments

1	Executive Summary	Kass Green and Roger Mitchell
2	Federal sector	Michele Motsko
3	State sector	Tony Spicci, Tony Willardson
4	Private sector	John Copple, Cory Springer, Pete Becker
5	NGO sector	Joanne Gabrynowicz, Jack Hild
6	Academic sector	Julie Sweetkind-Singer, Rebecca Moore, Dave Cowen
7	Evolving landscape for Landsat applications	Jack Hild, Peter Becker, Rebecca Moore

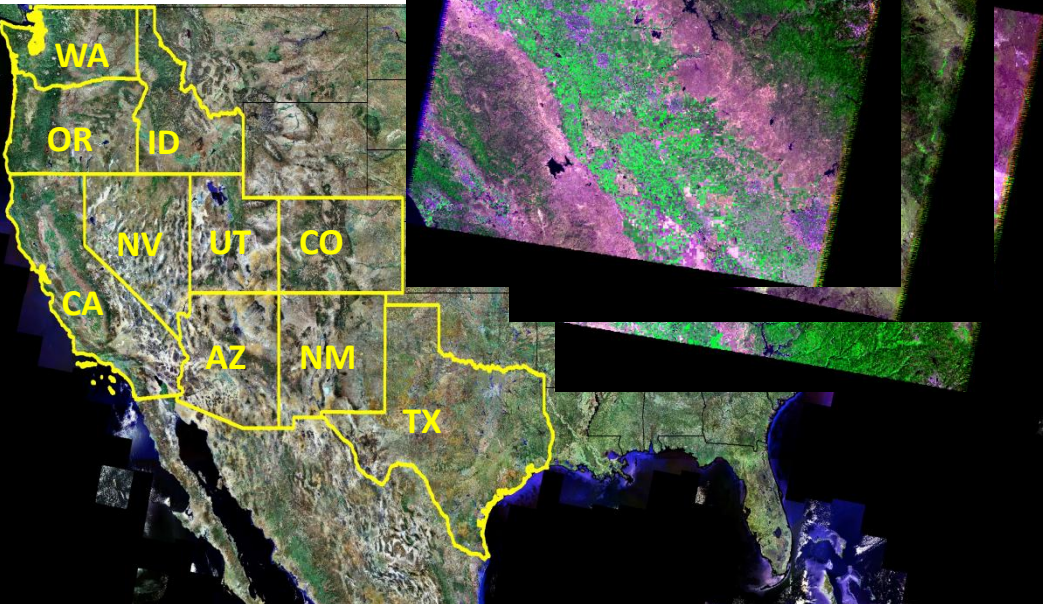
Status

- On track to have draft applications documented by Sept NGAC.
- New major apps
 - Fireline Wildfire Risk Assessment – ISO
 - Bureau of Reclamation – Colorado River Water Use
 - Global Forest Watch – UMD
 - Global Land Cover for USG – MDA
 - Oil & Gas applications
 - NGO applications
- Rebecca Moore is surveying entire Google Earth Engine
 - 2,000+ testers
 - Still receiving responses.
- Source research by Julie Sweetkind-Singer with Scopus catalogue

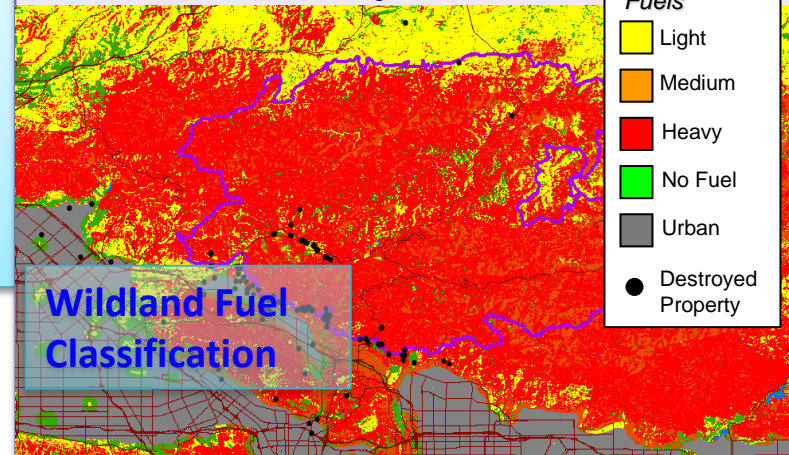
Industry-Leading Wildfire Risk Solution Uses Landsat

- FireLine is the insurance industry's leading wildfire risk solution covering millions of properties in 10 western states
- Landsat imagery is a key data source for wildland fuel mapping by Verisk subsidiary, AER
- Timely Landsat data is critical for regular product updates

Landsat Imagery



AER Expertise



aer
Atmospheric and
Environmental Research

Statewide Risk Map

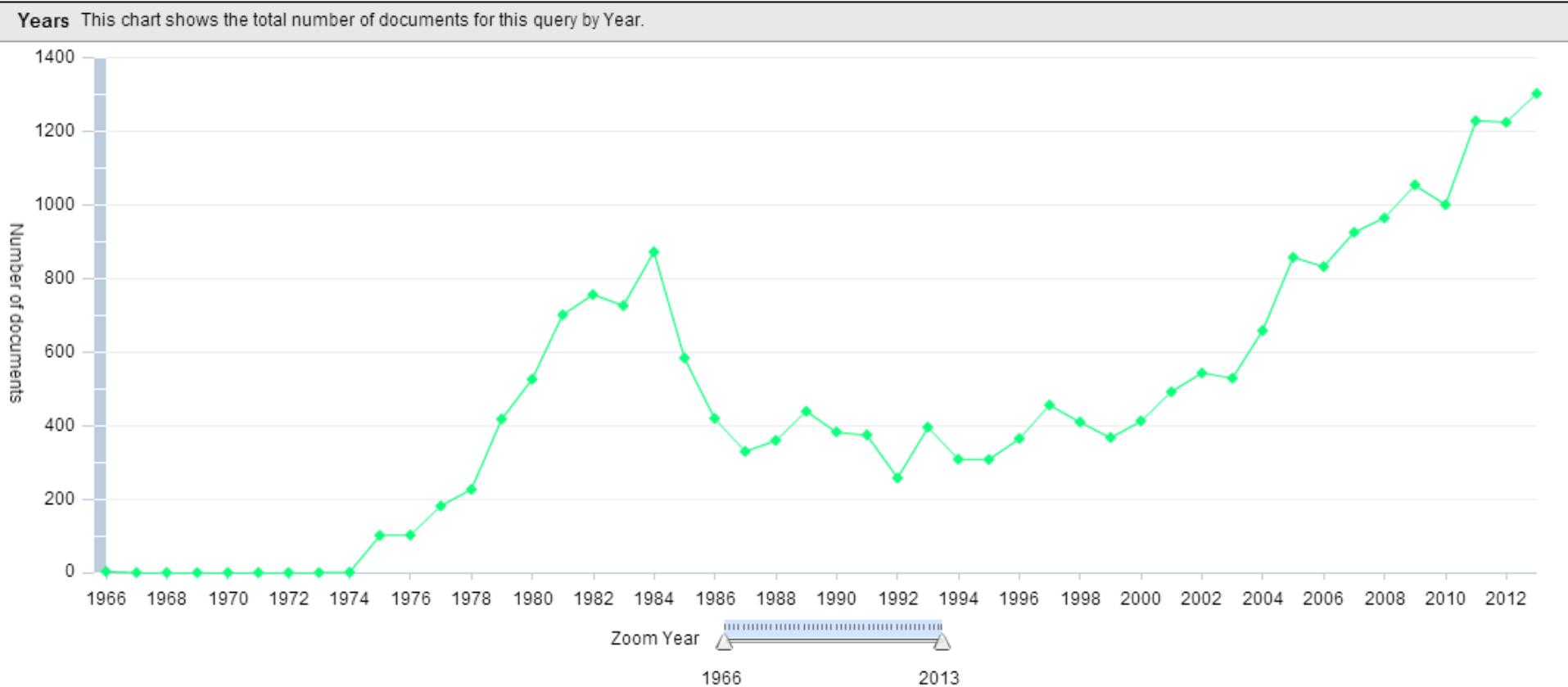
Wildfire Hazard

- Negligible and Low
- Moderate
- High and Extreme

Powered by AER Technology

Number of scientific documents by year for term “Landsat” (1966-2013)

22,384 documents using title/abstract/keyword

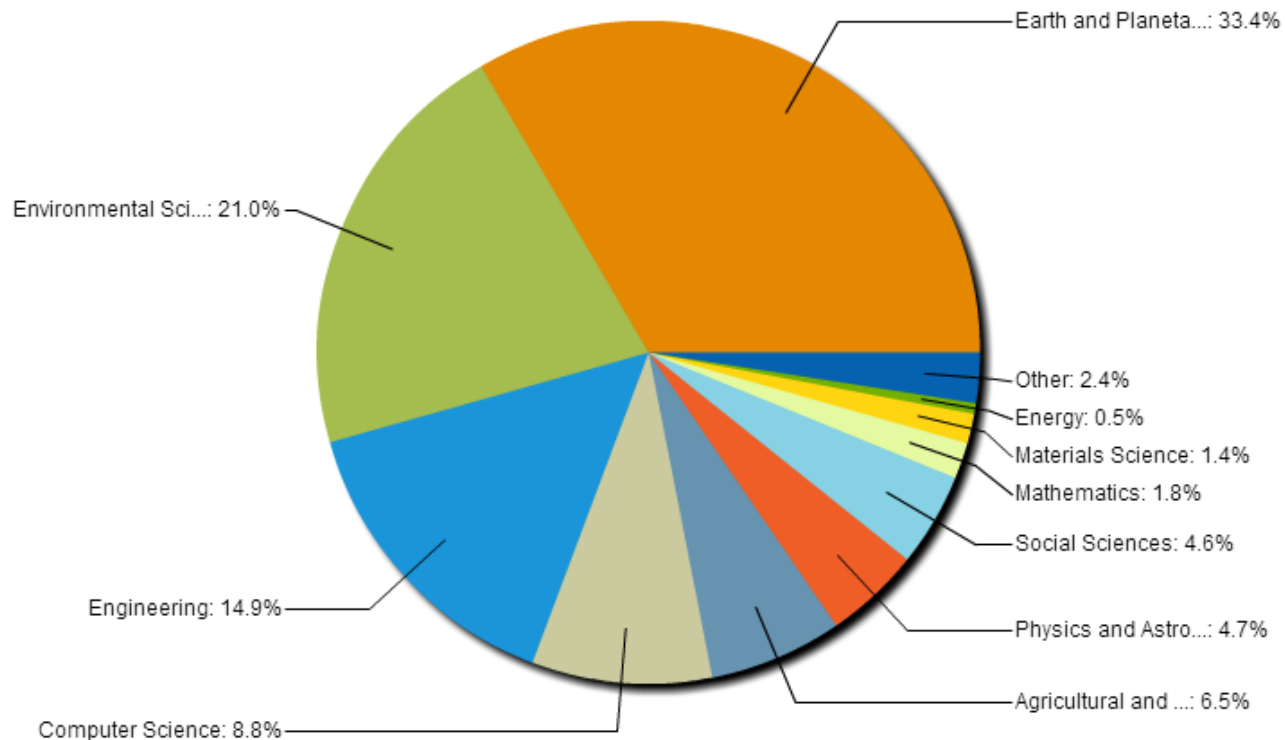


Source: Scopus database, accessed June 20, 2014.

Number of scientific documents by subject area for term “Landsat” (1966-2013)

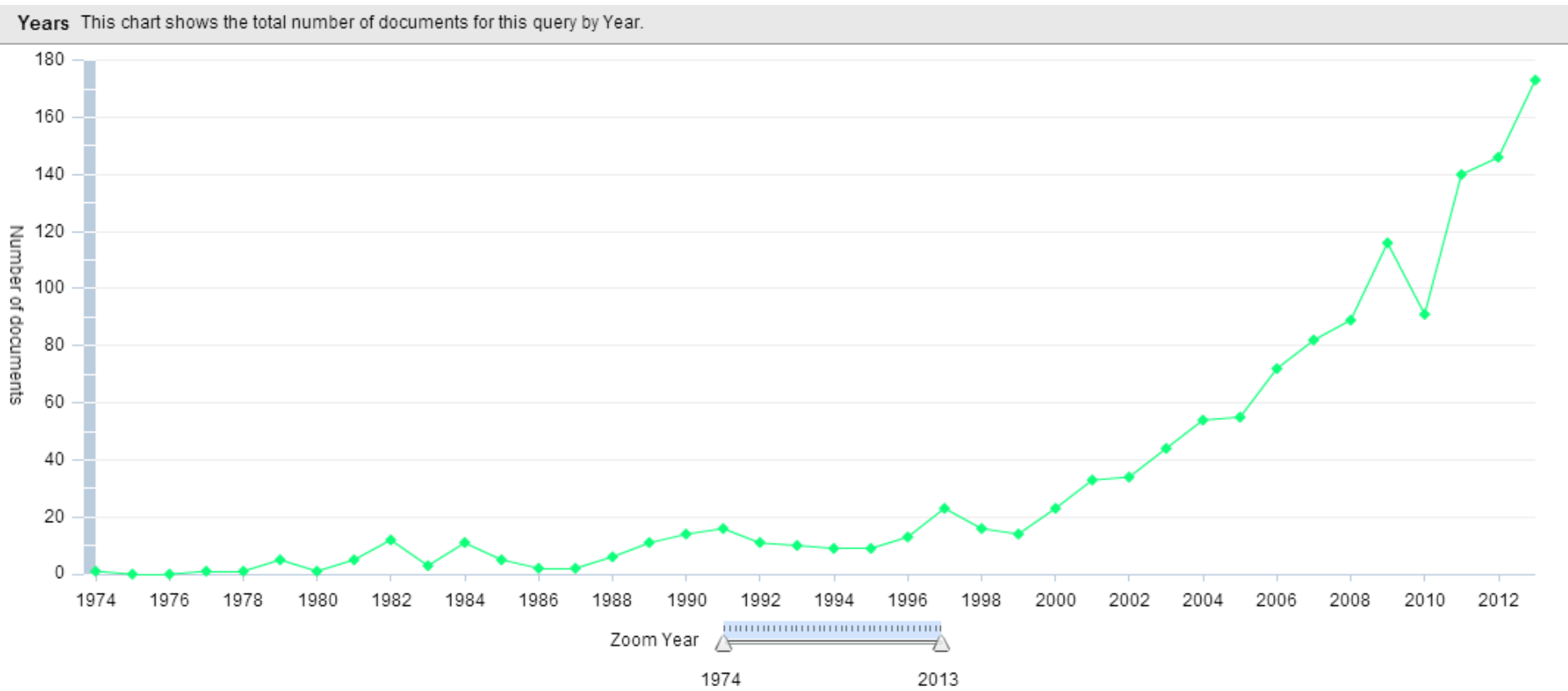
22,384 documents using title/abstract/keyword

Subject Areas This chart shows the total number of documents for this query by Subject Area.



Source: Scopus database, accessed June 20, 2014.

Number of scientific documents by year for term “Landsat” and “climate” (1966-2013) 1,353 documents using title/abstract/keyword



Source: Scopus database, accessed June 20, 2014.

3. We need LST input

- Please put us in contact with economically significant users of Landsat data.